CLAIMS

1. A method for determining a direction or parallelism of a beam, comprising:

forming a beam;

forming an adjusted intensity profile from at least a portion of the beam at a first position;

detecting an intensity profile of at least a portion of the beam downstream of the first position; and

determining a direction or parallelism of the beam relative to a reference direction based on a position of the detected intensity profile relative to a position of adjusted intensity profile formation.

2. The method of claim 1, wherein the step of forming a beam comprises forming a charged particle beam.

3. The method of claim 1, wherein the step of forming a beam comprises forming an ion beam for implanting dopant materials into a semiconductor material.

4. The method of claim 1, wherein the step of forming an adjusted intensity profile comprises blocking a portion of the beam.

5. The method of claim 1, wherein the step of forming an adjusted intensity profile comprises scanning a detection device in a direction transverse to the beam.

6. The method of claim 1, wherein the step of forming an adjusted intensity profile comprises:

positioning a detection device in the beam; and

determining a measure of intensity uniformity of the beam.

7. The method of claim 1, wherein the step of detecting an intensity profile comprises:

providing at least one detector downstream of the first position; and

detecting a change in beam intensity downstream of the first position with the detector.

8. The method of claim 1, wherein the step of detecting an intensity profile comprises:

moving a detector in a direction transverse to the beam direction; and

detecting a change in beam intensity that corresponds to the adjusted intensity profile.

9. The method of claim 1, wherein the step of determining a direction or parallelism comprises:

identifying a first position where an adjusted intensity profile that caused the detected minimum intensity profile was created;

identifying a second position where a minimum intensity profile is detected; and

determining a direction or parallelism of the beam based on the first and second positions relative to the reference direction.

10. The method of claim 1, further comprising:

forming a second adjusted intensity profile from at least another portion of the beam at a second position;

detecting a second intensity profile of at least another portion of the beam downstream of the second position; and

determining a direction or parallelism of the beam based on the positions of the detected intensity profiles relative to the positions of the first and second adjusted intensity profiles.

11. A method for determining a direction or parallelism of an ion beam, comprising:

forming an ion beam;

blocking a portion of the beam with a beam modifier;

identifying a position where a shadow is formed by the beam modifier; and

determining a direction or parallelism of the ion beam based on the position of the shadow relative to the position of the beam modifier.

12. The method of claim 11, wherein the step of blocking a portion of the beam comprises scanning a beam modifier in a direction transverse to the beam; and

determining a measure of uniformity of the beam.

13. The method of claim 11, wherein the step of identifying a position comprises:

detecting an intensity profile of the beam; and

determining a position of the beam modifier that corresponds to a detected minimum intensity.

14. An apparatus for determining a direction or parallelism of a beam, comprising:

means for forming a beam;

means for forming an adjusted intensity profile from at least a portion of the beam at a first position;

means for detecting an intensity profile of at least a portion of the beam downstream of the first position; and

means for determining a direction or parallelism of the beam relative to a reference direction based on a position of the detected intensity profile relative to a position of adjusted intensity profile formation.

15. An apparatus for determining a direction or parallelism of a charged particle beam, comprising:

at least one detector that detects an intensity profile of at least a portion of the charged particle beam;

a beam modifier that alters an intensity profile of at least a portion of the charged particle beam upstream of the at least one detector; and

a controller that determines a direction or parallelism of the charged particle beam based on positions of the at least one detector and the beam modifier relative to a reference direction and the detected intensity profile.

16. The apparatus of claim 15, wherein the controller determines a direction or parallelism based on the positions of at least one detector and the beam modifier relative to a reference direction at a point of minimum detected beam intensity.

17. The apparatus of claim 15, wherein the beam modifier includes a drive system that moves the beam modifier transverse to a path of the charged particle beam.

18. The apparatus of claim 15, wherein the beam modifier outputs a signal that is used to determine a measure of uniformity of the charged particle beam.

19. The apparatus of claim 18, wherein two detectors detect an intensity profile of two respective portions of the charged particle beam, and the beam modifier is a Faraday detector moved in a direction transverse to the charged particle beam.

20. The apparatus of claim 19, wherein the beam modifier is moved in a direction transverse to the beam direction along a workpiece plane.

21. An ion beam implantation apparatus comprising:
a charged particle beam generator that generates a charged particle beam; and
the apparatus of claim 15.

22. The apparatus of claim 21, wherein the charged particle beam generator scans the charged particle beam in a direction along at least a portion of a workpiece plane.